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ABSTRACT

The purpose of this study was to investigate the relationship between a developmentally disabled child's ability to perform (a) a simple rhythmic task, and (b) a series of gross and fine motor tasks. The subjects of this study were 77 boys aged 65 months (5.416 years) to 174 months (14.5 years). All were classified as educable mentally retarded, emotionally disturbed, and/or developmentally disabled. In addition, some of these children were believed to have minimal brain dysfunction or damage. The motor tests used in the comparison were (a) developmental test of visual-motor integration; (b) hopping right foot; (c) hopping left foot; (d) hop two right foot, two left, plus hop two left foot, two right; (e) body perception; (f) locomotor agility; and (g) standing broad jump. The rhythmic test required the subject to tap with a rhythmic signal from a metronome with a visible oscillating pendulum. The highest coefficients were between the rhythmic tests and the developmental test of visual-motor integration, while the lowest were between rhythmic ability scores and (a) body perception, and (b) standing broad jump scores. Results of comparisons suggest that temporal perception and rhythmic expression are related to certain motor abilities in exceptional children. (PB)

RHYTHM AND MOTOR ABILITY IN DEVELOPMENTALLY DISABLED CHILDREN

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A few deer darting across the countryside or an Olympic athlete running a race can be a picture of beauty. Conversely, a child with a developmental disability running a race may be far from a picture of beauty from a purely aesthetic point. Why? The ability of the Olympic athlete and the deer to move with ease and grace would be related to their innate synchrony; however, the developmentally disabled child often looks clumsy when running because this innate synchrony is absent, e.g., his or her feet may not operate at the same rate. Lack of synchrony in movement as seen by the Olympic track coach would be analogous to the dissonant sounds of a fifth grade band as heard by the maestro, for in synchronous movement such as running, there is a rhythm, i.e., repeated foot strikes occur at sequential intervals. Although the ability to move and act rhythmically may seem commonplace, it is an ability not possessed by everyone. It was hypothesized that a child's arrhythmicity is related to his or her awkwardness and clumsiness in areas where motoric dysfunction is manifested.

The purpose of this study was to investigate the relationship between a developmentally disabled child's ability to (1) perform on a simple rhythmic task, and (2) perform on a series of gross and fine motor tasks.

Review of Literature

Cooper and Glassow (1971) and Rasch and Burke (1971) have cited the importance of rhythm in relation to movement. Dunsing and Kephart (1965), and also Smoll (1974), have recognized the importance of rhythm in relation to the development of perceptual processes. Hiriartborde (1965) is of the opinion that kinesthesis plays a role in rhythmic ability. Fraisse (1964) has emphasized the role of rhythm in many motor behaviors, e.g., talking, walking and chewing. The lack of the ability to function rhythmically has been cited by Kalhan (1972) and Dunsing and Kephart (1965). Luria is also in agreement, for he has stated that some lack a "smooth kinetic melody" (1966).

Joseph and Heimlick (1959) are of the opinion that "rhythm is a primitive means of response." However, Dobbs (1966) believes that changing tempos can make intelligence a bigger factor when "slow learners perform rhythmic tasks." Carabo-Cone (1969), in a book entitled A SENSORY-MOTOR APPROACH TO MUSICAL LEARNING, states that children are irresistably drawn to imitate rhythmic movement. Haight (1944) found that a rhythmic response was most accurate when initiated by an auditory stimulus rather than by a combination of an auditory-visual stimulus. Although the preceeding references did not discuss rhythmic tests per se, criteria for rhythmic tasks for exceptional populations were inferred.

Tests for assessing rhythmic ability in normal populations have been reported by Seashore (1926), Drake (1950), Smith (1957), and Damarin and Catell (1968). Reitan (1966) has reported a rhythmic task in a neurologic workup; Liemohn and Knapczyk (1974b) reported a rhythmic factor in a factor analysis study done with exceptional children. Although instrumentation and scoring were different, the rhythmic test constructed had similarities to the aforementioned in that the testee is required to tap with a rhythmic signal from a metronome with a visible oscillating pendulum. Initially the tasks were conducted at 60 and 120 beats per minute with and without a visual stimulus. The scoring procedures were similar to those used in a test requiring hopping ability and reported by Ismail and Gruber (1967).

The reliability of the rhythm tests was determined by computing intraclass correlation coefficients (Baumgartner, 1969). The resulting r's ranged from .92 to .96. Objectivity coefficients were determined by having eight raters score a 104 month old boy whose test performance had been recorded on video-tape; the coefficients of concurrence were .80 for the slower speeds and 1.00 for the faster speed.

The motor tests used in the comparison were:

1) Developmental Test of Visual-Motor Integration (Beery, 1967),

2) Hopping Right Foot (Ismail & Gruber, 1967),

3) Hopping Left Foot (Ismail & Gruber, 1967),

4) Hop 2R2L + Hop 2L2R (Ismail & Gruber, 1967),

5) Body Perception (Cratty, 1969),

6) Locomotor Agility (Cratty, 1969), and

7) Standing Broad Jump (AAHPER, 1958).

The subjects of this study were 77 boys enrolled in the programs of the Indiana University Developmental Training Center; they ranged in age from 65 to 174 months ($\bar{X}$ = 112.91, S.D. = 25.80). All of the boys were evaluated in conjunction with the assessment programs of Indiana University Developmental Training Center. All gross motor testing was conducted by physical education personnel; the fine motor testing was conducted by either physical education personnel or by psychological services personnel. All subjects were classified educable mentally retarded, emotionally disturbed, and/or developmentally disabled. In addition, some of these children were believed to have minimal brain dysfunction or damage.

Results and Discussion

The highest coefficients were between the rhythmic tests and the Developmental Test of Visual Motor Integration (VMI). The VMI, a test which requires the testee to reproduce geometric designs, was designed to determine the degree to which visual perception and motor behavior are integrated in young children; conversely, the rhythmic tests would be more apt to determine the degree to which auditory perception and motor behavior are integrated. However, since both the VMI and the rhythmic tests require a perceptual integration followed by a motor expression, a relationship between the two seems logical.

In an unpublished study Cratty's Locomotor Agility Test was found to have rather high correlation coefficients with many psycho-motor variables, and high factor coefficients across a number of factors. This led to a factor analysis study of this particular test (Liemohn and Knapczyk, 1974a); in light of the aforementioned, the significant relationships found between Locomotor Agility and rhythmic ability are not surprising.

Some of the coefficients between the rhythmic tasks and the hopping tasks were also significant although to a lesser degree. The Hop 2R2L + Hop 2L2R tasks are tests that require rhythmic and sequencing hopping ability. It is quite possible that higher coefficients would have been found between rhythmic ability and singular hopping tasks from this same battery.

Of the items compared, the Body Perception Scores and the Standing Broad Jump scores had the lowest coefficients with the rhythmic ability scores.

Quite often the children evaluated on the rhythmic tests were either (1) not able to replicate the rhythmic signal (i.e., scored zero), or (2) able to replicate it perfectly (i.e., scored 9, the maximum). The presence or absence of organic pathology might be responsible for this dichotomy for Luria (1966) has reported that frontal and fronto-temporal lesions "lead to disturbance of the ability to integrate individual motor and acoustic stimuli into successive, serially organized groups." This might partially account for some of the relationships found for some of the motor variables require smooth changes from one link of the series to another. If the lesions were in the temporal divisions of the cortex, appreciable defects in serially organized acoustic processes might be found, but this should not necessarily have a deleterious effect upon the smooth performance of skilled movements.

In conclusion it would appear that a major factor responsible for the relationships found between the rhythmic ability tests and the items with which it was compared is due to commonalities in sensory integrative functioning ability. Synchrony in movement might also be expected to be related to the degree of sensory integrative functioning ability; both would appear to be related to the ability to score on the rhythmic tests devised. The results of the comparisons suggest that temporal perception and rhythmic expression are related to certain motor abilities in exceptional children.

Questions remaining to be elucidated include:

1) Why can some exceptional children reproduce rhythmic patterns while some cannot? Organic pathology is only suggested by this study.
2) Could a rhythmic training program for exceptional children result in concurrent gains in motor ability tasks which have a rhythmic component? Painter (1966) found that participation in a rhythmic training program contributed to normal kindergarten children's "perceptual motor spatial abilities," and Luria (1973) has reported some success in the rehabilitation of individuals sustaining brain trauma. It is quite possible that rhythmic training could have a salubrious effect upon the perceptual-motor development of some exceptional children.

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TABLE 1

Simple Correlation Coefficients,
Means and Standard Deviations

	Means	S.D.	1	2	3	4	5	6	7	8	9	10	11
1. VMI	11.41	5.78	1.00										
2. Hop Right	4.72	3.11	.54	1.00									
3. Hop Left	4.53	3.10	.61	.76	1.00								
4. Hop 2R2L/2L2R	8.19	11.06	.50	.44	.53	1.00							
5. Body Perception	7.66	2.23	.48	.38	.55	.39	1.00						
6. Locomotor Agility	7.07	2.55	.66	.56	.61	.41	.61	1.00					
7. Standing Broad Jump	44.68	14.91	.53	.51	.62	.31	.35	.59	1.00				
8. Age	112.91	25.80	.59	.43	.53	.34	.40	.48	.56	1.00			
9. Visual-Auditory 60	4.42	3.74	.55	.46	.57	.47	.41	.58	.36	.31	1.00		
10. Auditory 60	4.35	3.69	.51	.43	.48	.43	.31	.53	.22	.27	.85	1.00	
11. Auditory 120	4.62	3.71	.60	.56	.58	.55	.39	.62	.36	.39	.82	.82	1.00

TABLE 2

Partial Correlation Coefficients

	VA 60	A 60	A 120
VMI	.48	.45	.50
Hop Right	.38	.36	.47
Hop Left	.50	.41	.48
Hop 2R2L/2L2R	.41	.37	.48
Body Perception	.32	.22	.28
Locomotor Agility	.52	.48	.53
Standing Broad Jump	.24	.09	.25